

PART 1 GENERAL

- 1.1 Measurement and Payment .1 The unit prices bid for these items shall be full compensation for all work necessary and incidental for the supply, delivery, and installation of various types of retaining walls and their components to the lines, grades and cross-sections indicated in the Drawings and as directed by the DR.
- .2 Included in the price of the walls are the shaping of the subgrade and foundation pad surfaces, temporary grading, groundwater seepage and surface water management and slope stabilization during excavation and construction, sub-drainage system, including drain rock surround, installation of the Envirogrid cells as shown on the drawings (includes handling, connecting units, large zap strap connectors, granular base infill, infilling, compaction), infilling facing cell with organics concurrent with wall construction, supply and installation of railing foundation post sleeves concurrent with wall construction, premium costs for working around the wall system and any tie-back system and/or adjacent trees/environmentally sensitive zone, and dressing the toe of wall with backfill material, salvaged organics and woody debris as directed by the OEM. ~~Price shall also include costs related to support provided by Titan Environmental at the commencement of wall construction and at other critical intervals as outlined below.~~ Price shall include costs associated with construction of a three tier mock-up Envirogrid wall a minimum of 5 m long (i.e. two panel lengths) at the final approved location of Rest Area 5, or alternative location within the Park Reserve that is approved by Parks. Titan Environmental, supplier of the Parks owned Envirogrid Panels, could be requested to attend site to assist (at the contractor's cost). All materials and equipment shall be free of invasive species.
- .3 Additional payment under the appropriate tender items shall be made for stripping, excavation and disposal of unsuitable material, excavation, supply/placement/compaction of 75 mm Crushed Granular Subbase and placement biaxial reinforcement grid within the foundation pad zone, placement, and compaction of imported granular fill within the wall prism (i.e. zone behind the Envirogrid cells), supply and compaction of granular base material within the wall prism (for clarity – granular infill of the Envirogrid Cells is part of the wall price in Clause 1.1.2 above), placement of uniaxial geogrids, and safety railings where required. All materials and equipment shall be free of invasive species.
- .4 Measurement for payment for retaining walls shall be per square metre of wall face installed and measured from the bottom of the wall segments to the top.
- .5 Measurement for payment for tie-back geogrids shall be per square metre measured in place for each layer of grid installed, less overlap material.
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- 1.2 Scope of Work .1 This Section outlines the requirements for supply, and construction of mechanically stabilized earth (MSE) retaining walls. The wall locations are shown on the Contract Drawings.

The Work is defined as follows:

- .1 Fabrication and delivery of the walls and all necessary components including but not limited to: Envirogrid wall components. Envirogrid panels to be supplied by Owner.
- .2 Quality control during fabrication, delivery, and construction of the MSE Wall. As a component of the QC program, ~~a representative of Titan Environmental (supplier of the Parks owned Envirogrid panels) must be on-site at the commencement of construction of the first retaining wall and during subsequent critical stages of installation of the walls~~ Quality control during fabrication, delivery, and construction of the MSE Wall. As a component of the QC program, the contractor shall demonstrate that wall construction procedures are consistent with the supplier's recommended installation procedures and the wall design shown on the drawings through construction of a three tier mock-up Envirogrid wall a minimum of 5 m long (i.e. two panel lengths) at a location approved by Parks. The Owner's Geotechnical Engineer is to be present for construction of the mock-up. Wall construction procedures are to be approved by the Owner's Geotechnical Engineer prior to commencement of construction of the specified walls. Titan Environmental, supplier of the Envirogrid Panels, is a potential resource.
- .3 The Contractor shall cover the cost of construction, quality control, and project closure documentation including Record Drawings.

- 1.3 Related Work .1 Division 01 – General Requirements.
- .2 Section 01 33 00 – Submittal Procedures
- .3 Section 31 05 16 – Aggregates.
- .4 Section 31 24 13 – Highway and Trail Excavation, Embankment and Compaction.
- .5 Section 31 32 19 - Geotextiles
- .6 Section 32 11 16 – Granular sub-base (adjust to suit once granular fill spec is prepared).
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- 1.4 Reference Standards .1 Construction work is to be in accordance with the following standards and guidelines, except where specified otherwise. All standards are to be the most current issue at time of tender.
- .1 CAN/CSA S6-06, "Canadian Highway Bridge Design Code" (CHBDC) including recent updates.
  - .2 The Canadian Foundation Engineering Manual 4th Edition.
  - .3 AASHTO M288 Geotextile Specification for Highway Applications.
  - .4 AASHTO Standard Specifications for Highway Bridges, and accompanying Commentary, latest edition LFRD.
  - .5 American Society for Testing and Materials (ASTM) where noted.
- 1.5 Definitions .1 MSE: Mechanically Stabilized Earth is soil constructed with artificial reinforcing.
- .2 Reinforced Backfill: Soil that is used as fill behind the MSE concrete block face, and within the reinforced soil mass.
  - .3 Drain Rock: Free draining aggregate material used in drainage column (Wall 5) and surrounding drainage piping (all walls) . Refer to Section 31 05 16 - Aggregates.
  - .4 Foundation Soil: Soil supporting the leveling pad and reinforced soil zone of the retaining wall system.
  - .5 Geosynthetic: A planar product manufactured from polymeric material used with soil, an aggregate, or other geotechnical engineering materials.
  - .6 Geotextile: A permeable geosynthetic comprised solely of textiles used to separate dissimilar granular materials.
  - .7 Geogrid: A geosynthetic formed by a regular network of tensile elements and apertures, typically used for reinforcement applications.
  - .8 Non-woven Geotextiles: A Geosynthetic made of extruded synthetic polymer fibers or filaments that are needle punched or heat bonded in place into a non-woven mass.
  - .9 Wall Batter: The angle of the exposed face of the wall, as shown on the drawings.
- 1.6 Submittals .1 Construction Sequencing and Methodology Plan as outlined in Section 01 33 00
- 1.7 Related Sections .1 Section 01 35 43 - Environmental Procedures.
- .2 Section 01 35 44 – Cultural Resource Procedures.

## PART 2 – PRODUCT

- 2.1 MSE Wall General .1 Construction of the MSE wall must follow requirements noted in the referenced geotechnical report and according to manufacturer installation guidelines.
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- 2.2 Materials
- .1 Envirogrid Wall system consisting of contained granular base fill capable of supporting a completed wall face at a slope of 4 vertical to 1 horizontal or steeper. All Envirogrid cells shall be filled with compacted granular fill except the front face which shall be filled with nearby salvaged organic materials or as directed by the DR.
  - .2 Drain Rock
    - .1 To Section 31 05 16 – Aggregates.
  - .3 Granular Fill for EnviroGrid walls .1 To Section 31 05 16 – Aggregates – Granular Base.
  - .4 Leveling Pad
    - .1 To Section 31 05 16 – Aggregates - Granular Base (This shall be limited in thickness to less than 75 mm for final shaping of the foundation support zone in preparation for placement of the Envirogrid panels).
  - .5 Reinforced Backfill
    - .1 To Section 31 05 16 – Aggregates – Pit Run (typical) or Crushed Granular Sub-base (locally near existing slide area).
  - .6 Geogrid used in Reinforced Backfill
    - .1 TE-UX20PET uni-axial geogrids as described in Section 31 32 19 Geotextiles (supplied by PCA)
  - .7 Non-Woven (drainage) Geotextile
    - .1 Non-woven geotextiles for used to separate dissimilar granular materials shall be as described in Section 31 32 19 Geotextiles (supplied by PCA)

### PART 3 - EXECUTION

- 3.1 Delivery, Storage and Handling
- .1 Deliver, store, and handle materials in accordance with manufacturer's recommendations, in such a manner as to prevent damage. Check the materials upon delivery to assure that the appropriate material has been received. Store above ground on wood pallets or blocking. Remove damaged or otherwise unsuitable material, when so determined, from the site.
  - .2 Geosynthetics (including geosynthetic reinforcement, geotextile filter, , Envirogrid material or approved equal) shall be delivered, stored, and handled in accordance with ASTM D4873.
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- 3.2 Installation
- .1 Installation shall be completed according to wall supplier's instruction. The Contractor must have a supplier's representative on site at the time of construction of the first wall and at during subsequent critical stages of construction.
  - .2 All walls are to be supported on a 0.5 m thick foundation pad constructed with 75 mm minus crushed granular subbase placed and compacted in two lifts to a minimum of 95% Modified Proctor Maximum Dry Density (MPMDD).
  - .3 The foundation pad is to be placed on surface of non-organic, natural subgrade that is approved by the Owner's geotechnical engineer (expected to be firm to stiff clay or firm sandy clay).
    1. At Walls 1, 2, 3 and the west end of Wall 4 (i.e. upslope of the buttress), geotechnically approved subgrade is to be covered with a layer of composite grid (TE-BXC30, or approved equivalent);
    2. At Wall 4 / buttress a non-woven geotextile separator is to be installed at the natural subgrade/Crushed Granular Subbase interface;
    3. At Walls 1 & 2, and locally in the area of Trees 241/242 at Wall 4 a reinforcing layer of TE-BX20PP biaxial geogrid is to be installed at mid depth within the foundation pad; and,
    4. At Walls 4 and 5 the uniaxial geogrid reinforcing layers from the buttress and Wall 4, respectively, are to extend below the walls within the foundation pad zone.
  - .4 Retaining wall designs are based on Envirogrid EGA40 panels and TEUX20PET uniaxial geogrid that Parks has in stock from the previous phase of the project. The EGA panels are 0.9 m wide and two panels are to be secured together at each row with large "zap straps" provided by the manufacturer to form the facing zone;
  - .5 Envirogrid cells are to be filled with 19 mm granular base compacted to minimum 95 % MPMDD. The outer cell of the Envirogrid panels is to be filled with salvaged organics that are approved by the OEM;
  - .6 Walls shall be constructed with a minimum toe embedment of 0.5 m into mineral soil.
  - .7 The wall facing is to be constructed with a batter of 14 degrees relative to vertical (Approximately 1H:4V) or less steep if space permits;
  - .8 The handrail post footing sleeve is to be installed at the time of wall construction. Envirogrid panels are not to be cut;
  - .9 Wall backfill is to be 75 mm Pit Run in the project documents that is placed and compacted in 200 mm thick lifts to a minimum 95% MPMDD. Locally near the base of the former slide area, wall backfill shall be 75 mm Crushed Granular Subbase;
  - .10 Uniaxial geogrid is to be installed at vertical intervals of 400 mm (every second lift). Uniaxial geogrid lengths are measured relative to the back of the organic
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filled facing cell;

- .11 Locally, at the toe of the buttress, uniaxial geogrid reinforcement from the buttress is to extend into the trail and retaining wall zone as shown on the drawings. Separate geogrid from different structures by a minimum 50 mm thick layer of granular base course material; and,
- .12 Drainage is to be provided as noted for each wall.

**END OF SECTION**

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